

Date. 1903.	G.M.T. Mag.		Path				Length.	Dura- tion.	Remarks.	Probable Radiant.	
			From		To						
			α	δ	α	δ					
Nov. 15	^h 16	^m 45	♀	138 ⁰	+ 12 ⁰	134 ⁰	+ 7½ ⁰	6 ⁰	^{sec.} 0.5	swift, stk.	L.
	17	7	4	165½	+ 41	161½	+ 36	6	0.5	swift, stk.	177 + 49
	17	11	1	213	+ 29	223	+ 27	9	0.7	swift, stk.	L.
	17	14	4	173	+ 40½	190	+ 47	13½	0.9	swift, stk.	L.
	18	5	> 4	182	+ 51	195	+ 55½	9	0.7	swift, stk.	L.
	16	5 59	> 1	343	+ 38½	308	+ 34	29	3.5	v. slow, yellow train	42 + 20 58 + 9

Fig. 1 exhibits the increase in the hourly number observed. This was due to two causes—viz. the much greater density of that part of the stream through which the Earth passed towards 18^h and the improving position (higher altitude) of the radiant as the night progressed.

In fig. 2 the diffuse character of the radiant is shown by the intersecting lines of flight of a number of well-observed *Leonids*. In some cases the meteors appeared outside the limits of the diagram, but their paths have been carried backwards through the radiant.

Bishopston, Bristol: 1903 November 25.

Cape Double Star Results, 1903. By R. T. A. Innes.

(Communicated by Sir David Gill, K.C.B., F.R.S., H.M. Astronomer.)

The observations in 1903 were confined to a few nights in February and March.

All the measures have been made with the Repsold micrometer on the 18-inch refractor. The assumed value of one revolution of the micrometer screw has been taken as 17".600.

An explanation of the columns headed "Diff. of Mags." and "Colours" is given on p. 471 of the *Monthly Notices* for 1902 April, vol. lxii.

My measures of double stars with the above instrument extend altogether from 1899 November to 1903 March, and are now brought to a close by my transfer to the Transvaal. My thanks are due to Sir David Gill for his constant encouragement and help, and for the clerical assistance placed at my disposal. The work was greatly facilitated by the mechanical conveniences of the McClean Observatory, the rising floor in particular being of the utmost value for double-star work.

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Star Results, 1903.

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Star.	Mag.	1900.		1902+	Pos. Angle.	Dist.	Diff. of Mags.	Colours		No. of Nights.	Remarks.
		R.A.	S. Dec.					A	B		
Innes 387 ...	8.0	h m	° ' 23	16	142.0	0.51	0.0	2, 2	I		
„ 388 ...	8.3	3 14	63 39	16	314.5	0.62	0.2	...	I		
Cape 38 ...	9.0	3 42	40 29	16	211.7	3.96	0.5	...	I		
h 3642 ...	6.7	4 15	34 9	16	159.8	6.05	2.0	2, b	I		
Innes 413 ...	7.8	4 23	24 41	16	349.8	0.80	0.8	...	I		
h 3683 ...	6.6	4 39	59 8	16	80.6	1.54	0.1	3, 3	I	I	
Cordoba [9]...	7.4	4 39	48 1	16	234.8	3.73	2.0	2, b	I	2	
„ [10]...	7.5	4 46	50 3	16	258.4	4.82	2.5	2, b	I		
Innes 342 ...	7.5	4 47	54 4	16	175.5	0.91	0.5	3, 3	I		
„ 343 ...	7.8	4 48	54 37	16	45.6	2.56	3.5	...	I		
λ 42 ..	6.9	4 49	51 54	16	Single	...	...	...	I		
h 3707 ...	9.2	4 51	59 55	16	270.6	8.50	3.0	...	I		
Innes 274 ...	8.0	5 0	50 56	16	259.4	3.34	1.7	2, b	I		
Cordoba [12]	8.4	5 2	40 42	17	241.8	2.14	0.4	1, 1	2		
h 3743 ...	8.5	5 12	60 6	17	131.4	5.11	1.7	b, 2	2		
Cordoba [13]	8.8	5 14	27 36	16	274.0	3.21	0.4	...	I		
Innes 61 ...	7.8	5 15	41 9	22	100.5	0.91	0.5	1, 1	I		
„ 414 ...	6.4	5 21	56 15	19	Single	...	...	...	2	3	
θ Pictoris ...	6.3	5 23	52 24	19	194.3	0.48	0.3	3, 3	2		
Innes 346 ...	5.9	5 24	41 2	19	180 ±	15 ±	8.1	...	I	4	
h 3770 ...	7.6	5 29	24 24	22	16.4	4.17	3.2	3, b	2		
Innes 278 ...	8.5	5 43	68 45	19	174.2	1.20	2.5	...	2		
„ 279 ...	8.5	5 43	43 18	20	2.0	0.75	1.8	3, 3	3		
„ 63 AB	7.1	5 46	48 57	22	12.5	1.19	1.8	...	I		
„ „ AC				22	209.6	32.3	6.5	...	I		
h 3807 ...	8.3	5 49	41 42	16	270.8	5.15	2.7	2, b	I		
Cape 39 ...	9.4	6 19	73 26	17	259.9	5.49	1.1	...	2		
G Puppis ...	6.0	6 23	48 7	16	132.5	1.30	3.0	2, b	I		
Innes 350 ...	7.5	6 26	45 43	22	10.6	15.9	5.0	...	I		
Lac. 2333 AB	5.7	6 27	50 10	19	261.1	0.64	0.1	3½, 3½	2		
„ CD	6.7			19	117.8	0.40	0.0	6½, 6½	2		
β 754 ...	7.0	6 31	33 56	19	36.3	0.87	0.4	3, 3	2		
Innes 178 ...	8.3	6 31	32 14	19	203.1	0.80	2.0	...	2		
C.Z. 1518 ...	7.6	6 33	48 12	19	201.2	10.7	1.8	2½, b	2		
Dunlop 31 ...	5.0	6 36	48 8	16	319.2	13.5	2.0	4, b	I		
Innes 180 AB	8.5	6 42	52 19	16	336.5	0.81	1.0	...	I		
„ 157 ...	7.0	6 45	54 35	16	343.6	1.92	3.0	2, b	I		
„ 158 ...	7.2	6 45	48 27	22	184.0	1.69	3.5	3, b	I		

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Star.	Mag.	1900.			1902 +	Pos. Angle.	Dist.	Diff. of Mags.	Colours		No. of Nights.	Remarks.
		R.A.	S. Dec.						A	B		
Innes 181 ...	8.0	h 6 47	m 44 56	22	255.0	0.68	1.0	0, 0	1			
„ 182 ...	8.0	6 47	28 36	22	136.3	0.79	2.0	0, 0	1			
„ 431 ...	8.5	6 47	28 37	22	321.5	0.37	0.0	...	1		5	
„ 432 ...	7.8	6 53	28 36	22	213.2	1.65	0.0	...	1			
„ 65 ...	6.3	6 54	35 23	18	216.3	0.30	0.0	3½, 3½	3		6	
Innes 184 ...	8.0	7 8	60 25	18	179.3	0.71	0.4	...	3			
Harvard ...	6.0	7 11	63 1	19	153.2	0.53	0.4	2, 2	2			
Innes 7 ...	7.3	7 15	46 49	22	212.0	1.10	...	4, b	1			
„ 391 AB	8.7	7 16	21 42	16	275.2	4.67	0.2	...	1			
„ AC				16	30 ±	5 ±	4.3	...	1			
Innes 312 ...	7.7	7 19	75 41	22	166.9	0.88	0.0	3, 3	1			
„ 352 ...	8.5	7 22	37 57	19	356.6	0.67	0.6	0, 0	2			
h 3997 ...	6.1	7 37	74 3	16	293.2	1.65	0.1	2, 2	1			
h 4003 ...	9.2	7 44	23 56	18	117.0	31.2	1.7	½, 6	2		7	
Innes 161 ...	5.3	7 44	38 16	18	84.5	10.6	4.0	1, b	1			
Cape 20 ...	8.5	7 45	44 18	18	88.1	3.49	1.0	...	1			
ξ Argus ...	3.4	7 45	24 37	18	241 ±	...	...	...	1		8	
Howe 8 ...	5.0	7 49	34 27	18	289.2	2.94	3.0	2½, b	2			
β 333 ...	7.7	7 57	22 4	18	45.1	1.83	2.5	...	2			
Howe ...	8.5	7 58	26 59	18	331.1	2.49	2.5	...	1			
h 4041 ...	7.8	8 1	22 9	17	Single	...	...	...	1			
Lac. 3146 AB	6.5	8 2	33 17	20	87.4	22.3	2.0	4, b	2			
„ AC				20	58.3	27.9	4.0	...	2			
Innes 164 ...	7.5	8 3	39 49	22	83.9	0.62	1.0	...	1			
„ 193 ...	8.1	8 10	34 26	17	103.8	2.48	1.5	...	2			
Howe 9 ...	8.7	8 13	26 58	17	118.1	3.26	0.1	0, 0	2			
Cordoba [77] ...	8.2	8 29	50 38	18	99.3	3.53	1.3	3, b	2			
Innes 68 ...	8.6	8 33	30 29	17	67.2	7.49	2.0	...	2			
Cordoba [19] ...	8.0	8 37	31 27	18	328.8	5.49	2.7	3, b	2			
Innes 315 ...	8.5	8 38	42 14	18	166.8	0.99	0.2	...	1			
„ 70 ...	7.0	8 44	38 34	18	111.9	1.58	2.0	...	1			
„ 317 ...	8.5	8 52	43 5	18	304.3	2.19	1.5	1, b	1			
h 4164 ...	7.5	8 56	65 49	18	145.9	10.7	2.5	4, B	1			
δ ₂ Carinae ...	5.2	8 57	58 42	18	20.8	28.2	...	...	2			
Innes 357 ...	8.4	8 58	23 21	24	177.1	0.67	0.1	...	1			
h 4165 ...	5.4	8 59	51 48	24	103.6	1.46	2.0	2, —	1			
Innes 319 ...	9.1	9 10	82 37	18	86.2	4.47	1.0	...	1			
„ 11 ...	6.5	9 12	45 8	22	271.7	0.91	1.5	...	1			

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Star Results, 1903.

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Star.	Mag.	1900.				Pos. Angle.	Dist.	Diff. of Mags.	Colours	No. of Nights.	Remarks.
		R.A.	S. Dec.	1902+							
		h m	° ' "		° ' "				A B		
Innes 358 ...	5.4	9 16	68 16	18	133.0	18.1	7.1	3, —	1		
Cape 33 ...	8.4	9 16	69 58	20	339.0	4.76	0.6	2½, 0	2		
Innes 198 ...	8.0	9 16	28 48	22	178.9	0.33	...	...	1		
„ 170 ...	7.5	9 17	34 56	22	32.4	1.31	3.0	...	3		
„ 12 ...	5.4	9 18	74 28	22	263.3	0.31	0.3	2½, 2½	2		
„ 72 BC	9.6	9 23	52 57	21	32.9	3.14	1.0	...	1		
„ 199 ...	7.8	9 23	69 59	18	136.1	2.69	2.5	0, b	1		
ψ Argus ...	3.5	9 27	40 2	20	24.1	0.29	...	3, 3	6-5		
Innes 203 ...	8.2	9 36	62 6	22	313.8	0.45	0.3	...	1		
Hargrave 28...	7.8	9 42	59 1	22	284.6	2.02	2.5	3, B	1		
Innes 204 ...	7.2	9 44	69 39	16	127.7	1.87	2.5	...	1		
„ 174 ...	8.4	10 28	61 4	16	46.0	1.06	0.5	...	1		
Jacob [8] ..	6.4	12 5	34 9	23	21.2	3.54	...	2, b	1		
Harvard AB...	6.2	12 23	55 51	23	275.4	27.2	6.8	...	1		
AC...				23	290.2	48.9	5.8	...	1		
γ Centauri ...	2.4	12 36	48 25	22	353.6	1.42	0.0	3, 3	3		
Cordoba [27]	8.3	12 39	61 40	23	98.1	4.80	...	6, b	1		
Harvard ...	6.7	12 47	53 17	23	210.6	6.05	5.0	4½, —	2		
Innes 399 ...	7.5	13 8	62 7	23	137.6	8.32	4.0	3, —	1		
„ 400 ...	8.8	13 22	42 41	23	151.5	4.75	3.0	3, b	1		
h 4598 ...	7.0	13 33	74 37	23	46.5	13.1	4.0	3, —	1		
h 4616 ...	9.5	13 45	70 41	23	349.5	4.55	1.0	...	1		
Harvard ...	5.2	14 8	56 37	23	169.3	33.6	...	...	1		
„ ...	5.9	14 9	66 7	23	307.0	24.1	7.1	...	1		
Dunlop 159 AB	5.0	14 15	58 0	18	160.2	9.51	2.0	4, B	1		
AC				18	255.0	20.7	8.5	...	1		
AD				18	4.0	45.6	5.5	...	1		
Innes 426 ...	5.6	14 24	44 52	18	313.6	10.5	5.0	2, —	1		
Innes 367 ...	8.0	14 32	64 17	18	357.6	4.15	4.0	3, —	1		
α Centauri ...	0.2	14 33	60 25	21	211.2	21.66	1.2	2.3, 4	10		
α Circini ...	3.4	14 34	64 32	20	236.0	15.8	4.0	2, 7½	2		
Innes 334 ...	9.0	15 54	71 37	23	141.0	2.53	1.5	2, b	1		

Remarks.

1. Fixed in angle ; some decrease in distance.
2. P.M. of 0''·094 towards 238°.1.
3. To be rejected as single.
4. Too faint to measure.
5. New. The chief star of the old pair h 3896.

L 2

6. The angle increases 10° a year.
7. Mag. from Cor. D.M. Estimated 8.0. Is 8.7 in C.P.D. and marked :
Angle decreasing, distance decreasing.
There is a 13th mag. star $200^\circ \pm, 35'' \pm$.
8. Change. Two careful estimations with the chief star out of the field.

Short Method for the Calculation of the Orbits of Celestial Bodies.
By D. A. Pio.

(Communicated by the Secretaries.)

1. *Gain of Time is the Object.*—The determination of the elements of the orbits described by a celestial body has been carried by Gauss to the highest pitch of perfection the present state of mathematical science allows us to reach. The author has not the pretension to propose a new method for solving the same problem ; he only intends to substitute short, simple, and easy calculations for those which the method of Gauss requires, and limits himself to the most simple case : how to determine the first approximate values of the elements of a newly discovered celestial body with the least loss of time, so as to render the calculation of a new orbit an easy performance.

On the authority of the illustrious French mathematician M. H. Poincaré, the writer begs to state that the calculation of the first approximate orbit, by Gauss's method, requires from fifteen to seventeen hours. A reduction to about six to seven hours is what the author is working for. A gain of about eleven hours with a sufficiently approximate determination of the elements would be a service to practical astronomers.

The author proposes, for attaining this short calculation of orbits, a modification of Gauss's method containing innovations of great practical interest for the efficient simplification of the mathematical work.

The writer begs to remark that the problem of orbits has been really solved long ago ; that the question is only how to render tedious calculations more easy, but not to present new theories by which the work of La Place, Olbers, and Gauss may be swept away. This is the point of view from which the author begs his work to be considered. Practical improvement, not radical subvertment, is the only amelioration Gauss has left posterity to accomplish.

2. *Preliminary Remarks.*—It is supposed that the data furnished by the observations and those taken from the solar tables are corrected for precession, nutation, and aberration of the fixed stars. Parallax and aberration in time are not taken into consideration. The calculations are made with logarithms to not more than five decimal places.